भारतीय मानक
Indian Standard

IS 13630 (Part 1) : 2019

सिरैमिक टाइलें — परिक्षण पद्धतियां, नमूने लेने तथा स्वीकार्यता का आधार

भाग 1 आयाम एवं सतह की गुणता ज्ञात करना

(दूसरा पुनरीक्षण)

Ceramic Tiles — Methods of Test, Sampling and Basis for Acceptance

Part 1 Determination of Dimensions and Surface Quality

(Second Revision)

ICS 91.100.23

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भारतीय मानक ब्यूरो
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FOREWORD

This Indian Standard (Part 1) (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Flooring, Wall Finishing and Roofing Sectional Committee had been approved by the Civil Engineering Division Council.

This standard (Part 1) was first published in 1993 and subsequently revised in 2006. This second revision incorporates the experience gained with the use of this standard and brings the standard in line with the latest developments in this field.

The following significant modification incorporated in this revision:

a) A graded sample size has been introduced to meet the requirements of large format tiles.

This Indian Standard is published in several parts. The other parts in this series are:

Part 2	Determination of water absorption and bulk density
Part 3	Determination of moisture expansion using boiling water
Part 4	Determination of linear thermal expansion
Part 5	Determination of resistance to thermal shock
Part 6	Determination of modulus of rupture and breaking strength
Part 7	Determination of stain and chemical resistance of unglazed tiles
Part 8	Determination of stain and chemical resistance of glazed tiles
Part 9	Determination of crazing resistance of glazed tiles
Part 10	Determination of frost resistance
Part 11	Determination of resistance to surface abrasion of glazed tiles
Part 12	Determination of resistance to deep abrasion of unglazed tiles
Part 13	Determination of scratch hardness of surface according to Mohs' scale
Part 14	Determination of impact resistance by measurement of coefficient of restitution
Part 15	Sampling and basis for acceptance
Part 16	Determinations of lead and cadmium given off by glazed tiles

In the formulation of this standard considerable assistance has been derived from the ISO 10545-2 : 1995 'Ceramic tiles — Part 2: Determination of dimensions and surface quality'.

The composition of the Committee responsible for the formulation of this standard is given in Annex A.

In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'.

Indian Standard

CERAMIC TILES — METHODS OF TEST, SAMPLING AND BASIS FOR ACCEPTANCE

PART 1 DETERMINATION OF DIMENSIONS AND SURFACE QUALITY

(Second Revision)

1 SCOPE

1.1 This standard (Part 1) covers methods for determining the dimensional characteristics (length, width, thickness, straightness of sides, rectangularity, surface flatness) and the surface quality of all ceramic tiles.

1.2 Tiles with area less than 400 mm^2 are excluded from measurements of length, width, thickness, straightness of sides, rectangularity, and surface flatness.

1.3 Spacer lugs, glaze bobs and other irregularities of the sides shall be ignored when measuring length, width, and straightness of sides, rectangularity if these are subsequently hidden in the joints after fixing.

2 MEASUREMENTS OF LENGTH AND WIDTH

2.1 Apparatus

Vernier calipers or other suitable apparatus for linear measurement.

2.2 Test Specimens

a) For tiles with area, $A \leq 0.09$ m^2, ten whole tiles in each type shall be tested.

b) For tiles with area, 0.09 $m^2 < A \leq 0.36$ m^2, seven whole tiles in each type shall be tested.

c) For tiles with area, $A > 0.36$ m^2, five whole tiles in each type shall be tested.

2.3 Procedure

Measure each side of the tile under test at positions 5 mm from the corners. Measurements shall be made to the nearest 0.1 mm.

2.4 Expression of Results

The average dimension of square tiles is the average of four measurements. The average dimension of the sample is the average of all the measurements. For oblong tiles, each similar pair of sides of a tile provides the appropriate average dimension of the tile, an average of two measurements. The average dimensions for length and width are the average of all the measurements separately.

2.5 Test Report

The test report shall contain the following:

a) Description of the tiles;

b) All measurements of length and width;

c) Average size of each test specimen for square tiles; and the average length and width for each oblong tile;

d) Average size of all test specimens for square tiles and the average length and width of oblong tiles;

e) Deviation in percent of the average size of each tile (2 or 4 sides) from the work size; and

f) Deviation in percent of the average size of each tile (2 or 4 sides) from the average size of the all test specimens.

3 MEASUREMENTS OF THICKNESS

3.1 Apparatus

Micrometer screw gauge with anvils of 5 mm to 10 mm diameter, or other suitable apparatus.

3.2 Test Specimens

a) For tiles with area, $A \leq 0.09$ m^2, ten whole tiles in each type shall be tested.

b) For tiles with area, 0.09 $m^2 < A \leq 0.36$ m^2, seven whole tiles in each type shall be tested.

c) For tiles with area, $A > 0.36$ m^2, five whole tiles in each type shall be tested.

3.3 Procedure

a) *Titles with area, $A \leq 0.09$ m^2* — All tiles except split tiles, draw diagonals between the corners and measure the thickness at the thickest point within each of the four segments. Measure the thickness of each tile under test in four positions to an accuracy of 0.1 mm.

b) *Titles with area, 0.09 $m^2 < A \leq 0.36$ m^2* — All tiles except split tiles, divide the tile into six equal parts and measure the thickness at the thickest point within each of the six segments. Measure the thickness of each tile under test in six positions to an accuracy of 0.1 mm.

c) *Titles with area, $A > 0.36$ m^2* — All tiles except split tiles, divide the tile into nine equal parts and

measure the thickness at the thickest point within each of the nine segments. Measure the thickness of each tile under test in nine positions to an accuracy of 0.1 mm.

For split tiles, draw four lines at right angles across the extruded projections at distance of 1/8, 3/8, 5/8, 7/8 of the length measured from the end. Measure the thickness at the thickest point on each line.

3.4 Expression of Results

For all tiles the average thickness of each individual tile is the average of four measurements. The average thickness of the sample is the average of all measurements.

3.5 Test Report

The test report shall contain the following:

a) Description of the tiles;
b) All measurements of thickness;
c) Average thickness of each test specimen; and
d) Deviation in percent of the average thickness of each tile from the work size thickness.

4 MEASUREMENTS OF STRAIGHTNESS OF SIDES

4.1 Terminology

For the purpose of measurement of straightness of ceramic tiles according to this standard, the following definitions shall apply.

4.1.1 *Straightness of Sides* — Defined as the deviation from straightness of the centre of the side in the plane of the tile. The measurement is only relevant to the straight sides of tiles (*see* Fig. 3).

4.2 Apparatus

4.2.1 An apparatus as shown in Fig. 1, or other suitable apparatus such as steel square. The dial gauge (*A*) is used for measuring the straightness of sides.

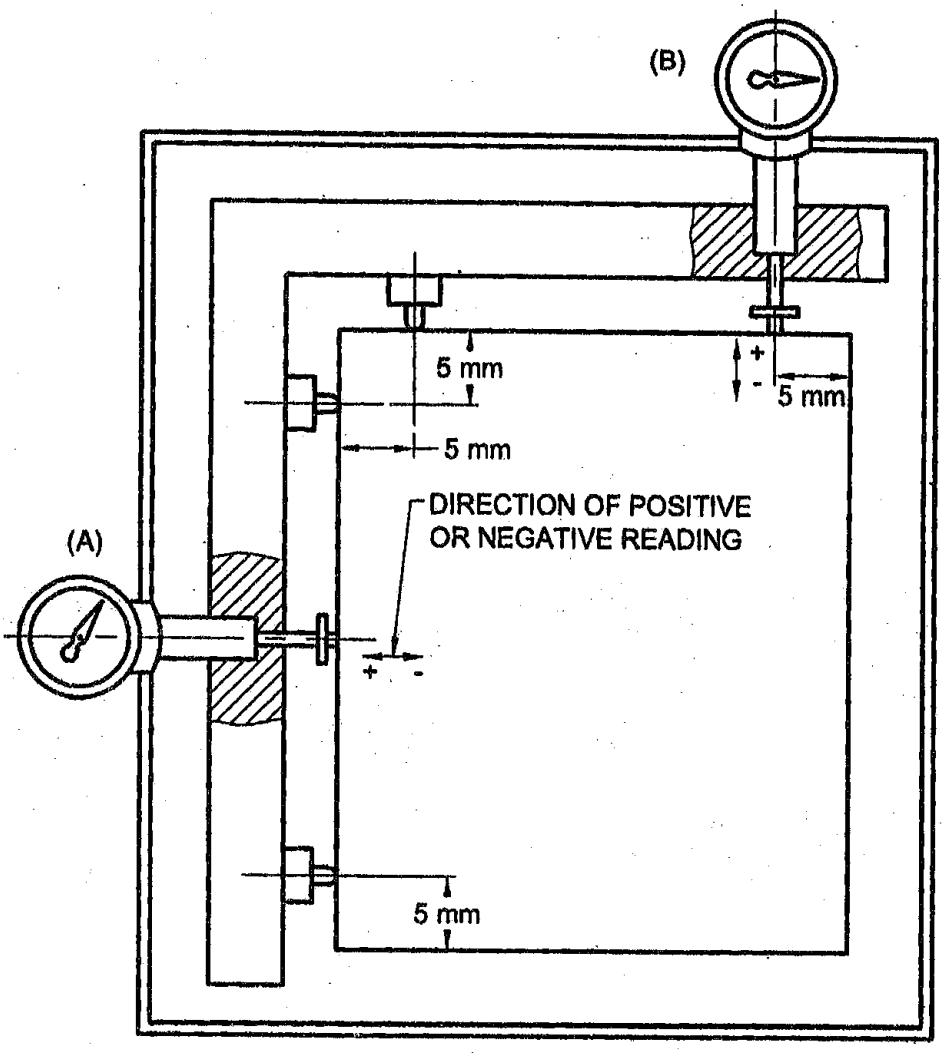

FIG. 1 APPARATUS FOR MEASUREMENT OF STRAIGHTNESS OF SIDES AND RECTANGULARITY

4.2.2 A calibrating plate, made of steel/aluminium of accurate dimensions and with straight flat sides.

4.3 Test Specimens

a) For tiles with area, $A \leq 0.09$ m^2, ten whole tiles in each type shall be tested.
b) For tiles with area, 0.09 m^2 $<A \leq 0.36$ m^2, seven whole tiles in each type shall be tested.
c) For tiles with area, $A > 0.36$ m^2, five whole tiles in each type shall be tested.

4.4 Procedure

4.4.1 Select an apparatus of the appropriate dimensions so that, when a tile is placed in the apparatus, the locating studs are 5 mm from the each corner of the side being measured.

4.4.2 Fit the appropriate calibrating plate exactly into position in the instrument and adjust the dial gauge reading to a suitable known value.

4.4.3 Remove the calibrating plate, place the proper surface of the tile on the locating studs in the apparatus and record the dial gauge reading in the center of the side. Rotate the tile, if square, to obtain four measurements. Repeat this procedure for each tile. In the case of oblong tiles, use separate instruments of the appropriate dimensions to measure lengths and width. Measure to an accuracy of 0.1 mm.

4.5 Test Report

The test report shall contain the following:

a) Description of the tiles;
b) All measurements of straightness of sides; and
c) Maximum deviation from straightness in percent, related to the corresponding work sizes.

5 MEASUREMENT OF RECTANGULARITY

5.1 Terminology

For the purpose of measurement of rectangularity of ceramic tiles according to this standard, the following definition shall apply.

5.1.1 *Deviation from Rectangularity* — If a corner of the tile is placed against the angle of an accurate calibrating plate (*see* Fig. 4), deviation in percent from rectangularity is defined as:

$$\frac{\delta}{L} \times 100$$

where

L = length of the adjacent sides of the tile, and
δ = deviation of the outer corner of the side of the tile (measured 5 mm from the corner) from the inner side of the calibrating plate.

5.2 Apparatus

5.2.1 An apparatus as shown in Fig.1, or other suitable apparatus such as steel square. The dial gauge (*B*) is used for measuring the rectangularity of sides.

5.2.2 A calibrating plate, made of steel/aluminium of accurate dimensions and with straight flat sides.

5.3 Test Specimens

a) For tiles with area, $A \leq 0.09$ m^2, ten whole tiles in each type shall be tested.
b) For tiles with area, 0.09 m^2 $<A \leq 0.36$ m^2, seven whole tiles in each type shall be tested.
c) For tiles with area, $A > 0.36$ m^2, five whole tiles in each type shall be tested.

5.4 Procedure

5.4.1 Select an apparatus of the appropriate dimensions so that, when a tile is placed in the apparatus, the locating studs are 5 mm from the each corner of the side being measured. The plunger of the dial gauge (*B*) shall also be 5 mm from the corner of the tile on the side being measured.

5.4.2 Fit the appropriate calibrating plate exactly into position in the instrument and adjust the dial gauge reading to a suitable known value.

5.4.3 Remove the calibrating plate, place the proper surface of the tile on the locating studs in the apparatus and record the dial gauge reading 5 mm from the corner. Rotate the tile, if square, to obtain four measurements. Repeat this procedure for each tile. In the case of oblong tiles, use separate instruments of the appropriate dimensions to measure lengths and width. Measure to an accuracy of 0.1 mm.

5.5 Expression of Results

Rectangularity shall be expressed as a percentage of the length and width for oblong tiles; and the size for square tiles.

5.6 Test Report

The test report shall contain the following:

a) Description of the tiles;
b) All measurements of rectangularity; and
c) Maximum deviation from rectangularity in percent, related to the corresponding work sizes.

6 MEASUREMENTS OF SURFACE FLATNESS (CURVATURE AND WARPAGE)

6.1 Terminology

For the purpose of measurement of surface flatness (curvature and warpage) of ceramic tiles according to this standard, the following definitions shall apply.

6.1.1 *Surface Flatness*

Defined by measurements in three positions on the surface of tiles. Tiles that have relief on the proper surface preventing measurements on that surface shall, where possible, be measured on the back.

6.1.2 *Centre Curvature*

The departure of the centre of a tile from the plane in which three of the four corners lie (*see* Fig. 5).

6.1.3 *Edge Curvature*

The departure of the centre of one edge of a tile from the plane in which three of the four corners lie (*see* Fig. 6).

6.1.4 *Warpage*

The departure of the fourth corner of a tile from the plane in which three of the four corners lie. (*see* Fig. 7)

6.2 Apparatus

6.2.1 For tiles larger than 40 mm × 40 mm the apparatus given in **6.2.1.1** and **6.2.1.2** shall be used.

6.2.1.1 An apparatus as shown in Fig. 2, or any other suitable instrument. Although only one dial gauge is shown in the figure, there are three on the instrument, located at the centre of one side, at the centre of the tile and at one corner. To measure smooth-surfaced tiles the support studs are 5 mm in diameter. In order to obtain meaningful results for other tile surfaces, suitable support studs shall be used.

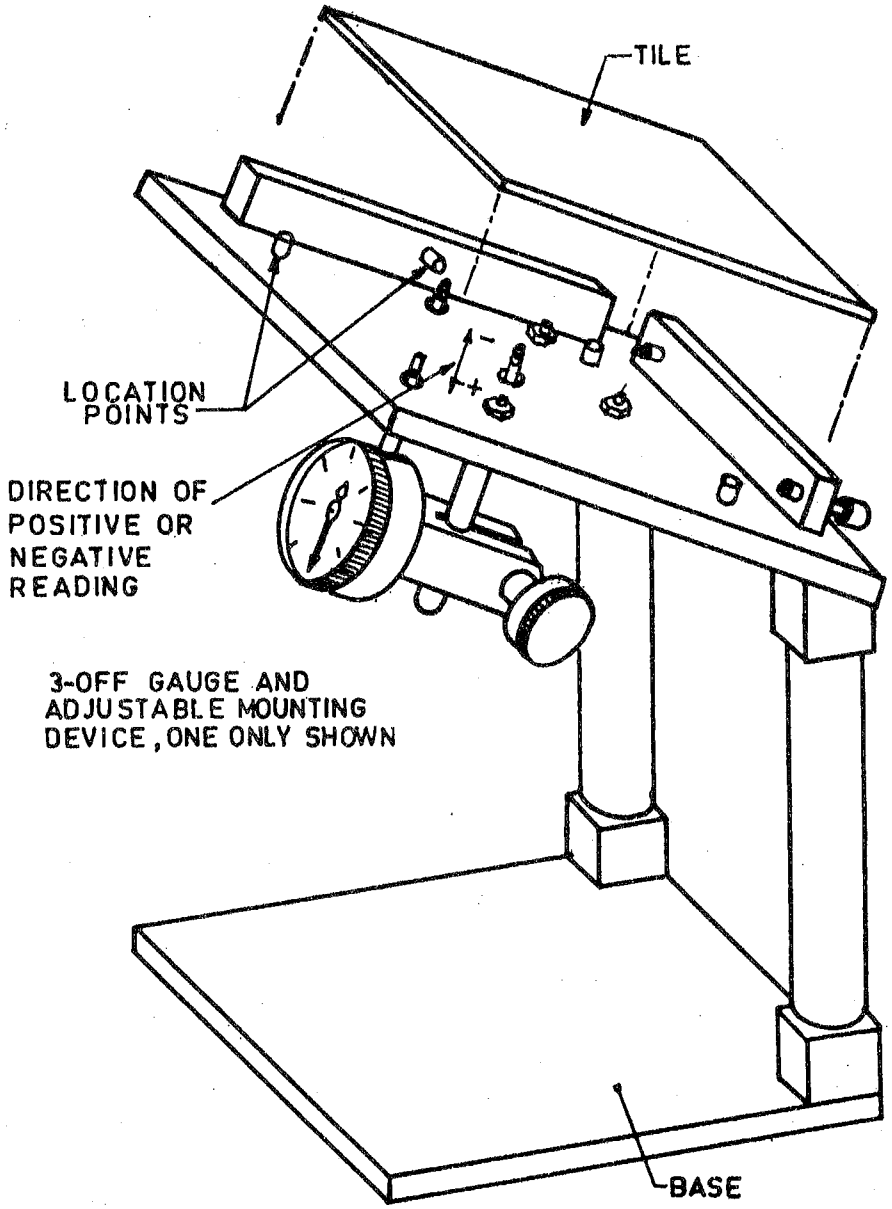

FIG. 2 APPARATUS FOR MEASUREMENT OF SURFACE FLATNESS

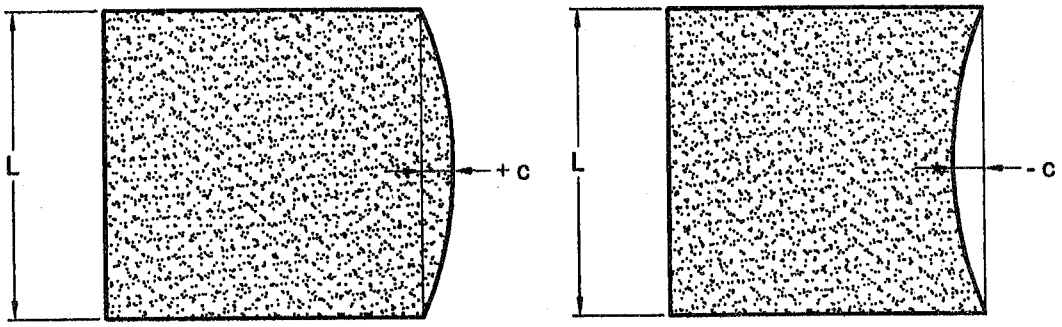

FIG. 3 STRAIGHTNESS OF SIDES; DEVIATION FROM STRAIGHTNESS (c/*L*)

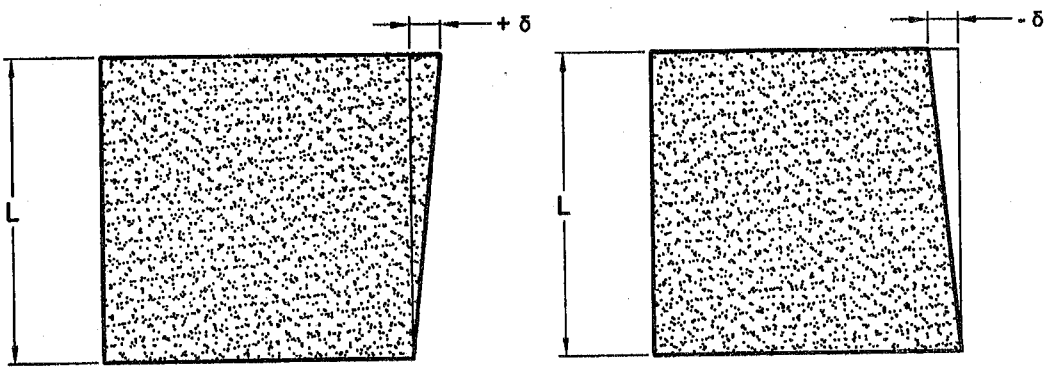

FIG. 4 RECTANGULARITY; DEVIATION FROM RECTANGULARITY (δ/*L*)

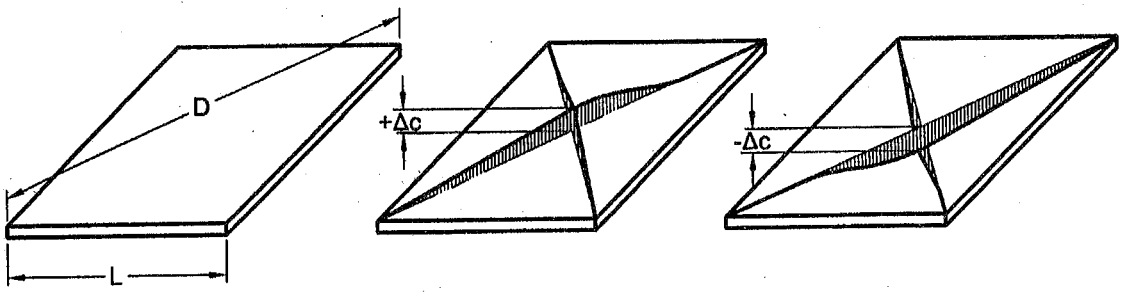

FIG 5 CENTER CURVATURE (Δ*c*/*D*)

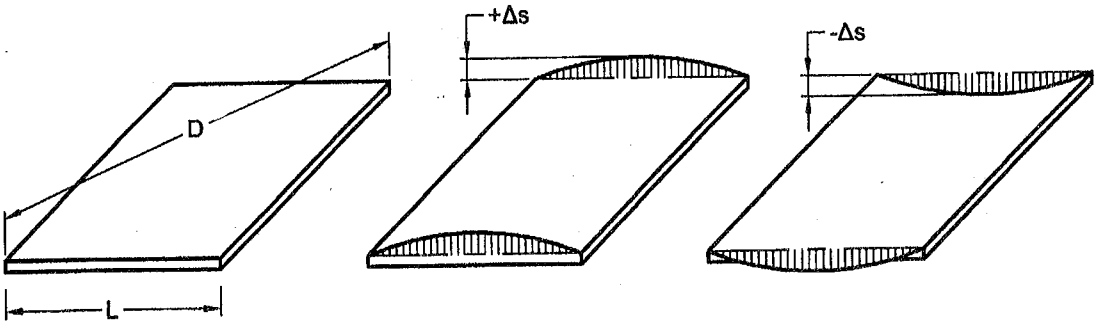

FIG 6: EDGE CURVATURE (Δ*s*/*L*)

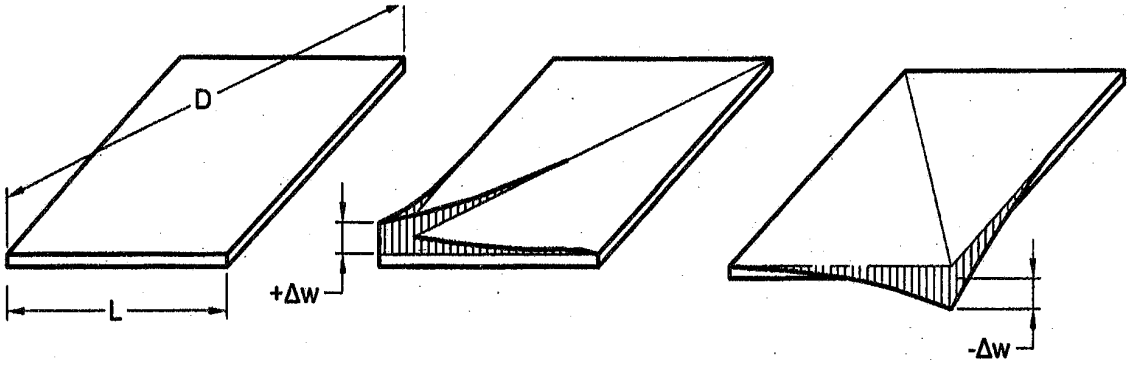

FIG 7: WARPAGE ($\Delta w/D$)

6.2.1.2 True flat calibrating plate of metal or glass and at least 10 mm thick for the apparatus described in **6.2.1.1**.

6.2.2 For tiles of dimensions 40 mm × 40 mm or less the apparatus given in **6.2.2.1** and **6.2.2.2** shall be used.

6.2.2.1 *Metal straightedge*

6.2.2.2 *Thickness feeler gauges*

6.3 Test Specimens

a) For tiles with area, $A \leq 0.09$ m^2, ten whole tiles in each type shall be tested.
b) For tiles with area, 0.09 m$^2 < A \leq 0.36$ m^2, seven whole tiles in each type shall be tested.
c) For tiles with area, $A > 0.36$ m^2, five whole tiles in each type shall be tested.

6.4 Procedure

6.4.1 *For Tiles Larger than 40 mm × 40 mm*

6.4.1.1 Select an apparatus of the appropriate size and place the corresponding calibrating plate exactly into positions on top of the three accurately positioned studs.

6.4.1.2 The centre of each stud is 10 mm from the side of the tile, and the two outer dial gauges are 10 mm from the sides of the tile.

6.4.1.3 Adjust the three dial gauges to a suitable known value.

6.4.1.4 Remove the calibrating plate, place a tile on the apparatus with proper surface of the tile downwards and record the three dial gauge reading in the center of the side. Rotate the tile, if square, to obtain four measurements of each properties. Repeat this procedure for each tile. In the case of oblong tiles, use separate instruments of the appropriate dimensions. Record the maximum centre curvature, edge curvature and warpage for each tile. Measure to an accuracy of 0.1 mm.

6.4.2 *For Tile Dimension of 40 mm × 40 mm or Less*

6.4.2.1 In order to measure edge curvature, place a straightedge across the edges and measure the gap under the straightedge by means of the feeler gauges. Determine centre curvature in the same manner but along diagonals.

6.4.2.2 There shall be no warpage measurements.

6.5 Expression of Results

6.5.1 Centre curvature is expressed as a percentage of the length of the diagonal.

6.5.2 Edge curvature is expressed as percentage of the length and width, for oblong tiles and percentage of the size for square tiles. Warpage is expressed as a percentage of the length of the diagonal.

6.5.3 Measurements for tiles with spacer lugs shall be expressed in mm.

6.6 Test Report

The test report shall contain the following:

a) Description of the tiles;
b) All measurements of centre curvature;
c) All measurements of edge curvature;
d) All measurements of warpage;
e) Maximum centre curvature, in percentage, related to the diagonal calculated from work size;
f) Maximum edge curvature, in percentage, related to the corresponding work size; and
g) Maximum warpage, in percentage related to the diagonal calculated from work size.

7 SURFACE QUALITY

7.1 Surface Defects and Intentional Effects

7.1.1 Criteria for assessing the surface quality of glazed, engobed and unglazed tiles are as follows:

a) Cracks,
b) Crazing,

c) Short glazing,
d) Unevenness,
e) Depressions,
f) Holes,
g) Glaze devitrification,
h) Specks and spots,
j) Under glaze faults,
k) Decorating faults,
m) Shading,
n) Nipped edges, and
p) Nipped corners.

7.1.2 In order to judge whether an intentional decorative effect is acceptable or is a defect; see the relevant clause of the product standard. Cracks, nipped edges and nipped corners cannot be intentional effects.

7.2 Apparatus

7.2.1 *Fluorescent Lighting of Colour Temperature 6 000 K to 6 500 K*

7.2.2 *Meter Rule or Other Suitable Means of Measuring Distance*

7.2.3 *Light Meter*

7.3 Test Specimens

At least 2 m^2 with a minimum of 4 tiles shall be tested.

7.4 Procedure

7.4.1 Place the tiles with the proper surface under observation so that they can be viewed normally at a distance of 1 m. Illuminate them with an even light intensity of 300 lux at the surface of the tiles and check the light intensity at the centre and each corner of the area of tiles under test.

7.4.2 View the tiles with naked eye (with the aid of a spectacle, if usually worn).

7.4.3 Preparation of the test area and the viewing of the test shall not be performed by the same person.

7.4.4 Intentional effects in the surface shall not be regarded as defects.

7.5 Expression of Results

Surface quality is expressed as the percentage of tiles without defects.

7.6 Test Report

The test report shall contain the following:

a) Description of the tiles;
b) Number of tiles tested including the area of tiles tested;
c) Assessment criteria used; and
d) Percentage of tiles without defects.

ANNEX A

(Foreword)

COMMITTEE COMPOSITION

Flooring, Wall Finishing and Roofing Sectional Committee, CED 05

Organization	*Representative(s)*
In Personal Capacity (*L/109, Sarita Vihar, New Delhi*)	Shri Ashok Khurana (***Chairman***)
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Building Materials & Technology Promotion Council, New Delhi	Shri S. K. Gupta Shri Pankaj Gupta (*Alternate*)
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CSIR − Central Road Research Institute, New Delhi	Dr Rakesh Kumar
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Construction Industry Development Council, New Delhi	Shri P. R. Swarup Shri Ravi Jain (*Alternate*)
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Directorate General of Border Roads, New Delhi	Col Indra Kumar Jaggi
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Mapie Construction Products India Pvt Ltd, Bengaluru	Dr G. S. Ravi Shankar Shri Abhijit Dutta (*Alternate*)
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Morbi Dhuva Glaze Tiles Association, Morbi	Shri Nilesh Jetparia Shri Jeram Madhav Kavar (*Alternate*)
Municipal Corporation of Greater Mumbai, Mumbai	Representative

Organization	*Representative(s)*
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Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

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Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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